**Thermally treatable layer system that filters sun and heat and method for producing the same**

**Patent Claims**

1. The invention relates to a layer system that filters sun and heat and can be applied to glass by means of a vacuum coating process, said system comprising at least one series of metal layers in addition to a respective series of lower dielectric layers that are positioned directly below said assembly and a respective series of upper dielectric layers that are positioned directly above said assembly, characterised in that at least one metal layer system (4) as well as one upper (2) and one lower (3) dielectric layer system are configured as a sandwich system in which, within the metal layer system (4), a metal layer (8) consisting of at least one individual layer is encapsulated by an upper (9) and a lower (7) intermediate layer consisting of the hypostochiometrically nitrated or oxidised metal of the metal layer (8) and in which the lower (3) as well as the upper (2) dielectric layer system has a stochiometric layer (5, 11) of a metal or semiconductor oxide or metal or semiconductor nitride as well as at least one further hypostochiometric layer (6, 10) of the same metal or semiconductor oxide or metal or semiconductor nitride whereby within the dielectric layer systems (2, 3) the coatings are positioned in such a way that in comparison to the neighbouring layer, the layer with the greater oxygen or nitrogen deficit of the metal or semiconductor oxide or metal or semiconductor nitride always lies on the side turned towards the metal layer (8).

2. Thermally treatable layer system that filters sun and heat according to Claim 1, characterised in that the oxygen or nitrogen portion within a sandwich system is designed as a gradient.

3. Thermally treatable layer system that filters sun and heat according to Claim 1 or 2, characterised in that the dielectric of the dielectric layer systems (2, 3) is a nitride, oxide or oxynitride of silicon.

4. Thermally treatable layer system that filters sun and heat according to Claim 1 or 2 characterised in that the dielectric of the layer systems (2, 3) is a nitride or oxide of a metal or semiconductor whereby the refractive index of this nitride or oxide is more highly refractive in comparison with that of the silicon nitride.

5. Thermally treatable layer system that filters sun and heat according to Claim 4, characterised in that the dielectric of the layer systems (2, 3) is a nitride or oxide of a metal or semiconductor that has a refractive index in the range of approx. 2.0 to 2.7 measured at a wavelength of 550nm.

6. Thermally treatable layer system that filters sun and heat according to one of Claims 1 to 5, characterised in that the metal layer (8) is composed of a Ni:Cr alloy.

7. Thermally treatable layer system that filters sun and heat according to one of Claims 1 to 5, characterised in that the metal layer (8) is composed of chrome.

8. Thermally treatable layer system that filters sun and heat according to one of the Claims 1 to 5, characterised in that the metal layer (8) is composed of at least three individual layers of a metal that has electric conductivity in the magnitude of $10^7$ s/m.

9. Thermally treatable layer system that filters sun and heat according to Claim 8 characterised in that the middle individual layer of the metal layer (8) has an electric conductivity of approximately $6 * 10^7$ S/m.

10. Thermally treatable layer system that filters sun and heat according to one of Claims 8 or 9, characterised in that the layer system has at least one further metal layer system with one further adjacent dielectric layer system so that both assemblies constitute a periodic continuation of the assembly sequence of the lower and upper dielectric layer systems (2, 3) and the metal layer system (4).

11. Thermally treatable layer system that filters sun and heat according to one of Claims 6 or 7, characterised in that the upper (2) and the lower (3) dielectric layer system encompasses a stochiometric silicon nitride layer with a thickness of approximately 5.0 nm to 200.0 nm (50Å to 2000Å) and the thickness of the

further hypostochiometric silicon nitride layers of every dielectric layer system (2, 3) amounts to approx. 5.0nm to 50.0 nm (50Å to 500Å) in total, that the metal layer (8) has a thickness of approx. 1.0 nm to 100.0 nm (10Å to 1000Å) and every intermediate coating (7, 9) has a thickness of approx. 1.5 nm to 20.0nm (15Å to 200Å).

12. Thermally treatable layer system that filters sun and heat according to Claim 8 characterised in that the layer thicknesses of the available intermediate layers (7, 9) respectively above and below the metal layer (8) and/or the available dielectric layer systems (2, 3) respectively above and below the metal layer are identical.

13. Thermally treatable layer system that filters sun and heat according to one of Claims 1 to 12, characterised in that at least one hypostochiometric layer of the dielectric layer systems (2, 3) has such an oxygen or nitrogen deficiency that the extinction coefficient of this layer lies in the range between $1* 10^{-2}$ to $1*10^{-3}$.

14. Thermally treatable layer system that filters sun and heat according to Claim 13 characterised in that at least one hypostochiometric layer of the dielectric layer systems (2, 3) exhibit such a oxygen or nitrogen deficiency that the extinction coefficient of this layer lies in the range between $2* 10^{-3}$ to $3* 10^{-3}$.

15. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 1 in which the individual layers are applied one after the other to a glass substrate by means of a vacuum coating characterised in that at least one of the oxide or nitride layers are applied in a reactive vacuum coating process from a metallic or semiconductive coating source and in the presence of oxygen or nitrogen as a reactive gas.

16. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 1 in which the individual layers are applied one after the other to a glass substrate by means of a vacuum coating characterised in that at least one of the oxide or nitride layers are applied in a non-reactive or partially reactive vacuum coating process from a coating source which is composed of the stochiometric or hypostochiometric oxide or nitride of the material of the sandwich system and thereby no or only small amounts of oxygen or nitrogen are added to the working gas during the coating process.

17. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 16, characterised in that oxygen or nitrogen with a volume content of less than 10% of the volume of the working gas is added to the working gas during the coating process.

18. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 3 according to one of Claims 15 or 16, characterised in that the extraction of at least one of the dielectric layer systems (2 or 3) is carried out

from a coating source containing primarily silicon which has an aluminium content of approximately 5 to 15%.

19. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 3 according to one of Claims 15 or 16, characterised in that the extraction of at least one of the dielectric layer systems (2 or 3) is carried out from a coating source containing primarily silicon which has doping that increases the electric conductivity of the silicon coating source.

20. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 19, characterised in that the extraction of at least one of the dielectric layer systems (2 or 3) is carried out from a coating source containing primarily silicon that has boron doping.

21. Method for the manufacture of a thermally treatable layer system that filters sun and heat according to Claim 19, characterised in that the extraction of at least one of the dielectric layer systems (2 or 3) is carried out from a coating source containing primarily silicon which has carbon doping.